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The Emergence and Existence of Life in the World of Elements and the Physical Vacuum

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ABSTRACT

The physical vacuum affects not only the natural processes in deep space but also identifies the key features of the structure of ordinary matter. This sphere of work intersects the fields of chemistry and biology. The condition of the objective existence of elementary particles and the objectivity of quantum measurements require the presence of real physical analogues of clocks and lines that participate directly and literally in particle interactions. The analogue of the clock results from the existence of elementary particles in the form of the alternation of two states with different properties that can be modelled in terms of probabilistic behaviour, the uncertainty principle, and similar concepts. The analogue line appears due to the quasi-crystalline structure of the physical vacuum, thereby generating a real observed mass ratio and other features of the microworld. The emergence of life and sense is regulated by deterministic processes. Biological evolution is a process directed toward a slow and gradual adaptation to the physical vacuum as the real component of the environment. Because of such evolution, the geometric structure of living organisms transforms into a fractal increased in absolute terms by chemical simulation. Therefore, the analogue model defines the key structures of the vacuum. The geometric similarity of the structures allows cells to live in accordance with the laws of the quantum world without requiring the solving of equations.

The Key Step from the Formal Description to the Real Understanding of the World of Quantum Mechanics as a Habitat for Living Cells

More than 100 years ago, the physics of electrical phenomena infiltrated the field of chemistry and, thereafter, biology. In the beginning, many scholars considered this physics to be farfetched. This opinion was natural for an era wherein the only electrical device that had been introduced beyond laboratories was the lightning rod. Today, it is impossible to imagine the structure and chemistry of ordinary matter without the participation of electrons and ions. Scientific understanding has entered a new phase.

Now, it is clear that the physical vacuum not only affects the natural processes in deep space but also identifies the key features of the structure of ordinary matter. This sphere of work intersects chemistry and biology. It has become possible to study this unusual perspective based on living cells and the proper body in terms other than hypotheses and equations that are often incomprehensible

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even to the authors, but rather through direct observation with electronic and tunnelling microscopes. The proper understanding of the role of the physical vacuum in nature requires a relevant model of the vacuum, and the possibility of its creation has appeared only recently.

For decades, quantum mechanics was able to provide only a formal description. This necessary step enabled the creation of devices that guided research into a new phase of development. Today, the microcosm can be described more than mathematically: its structure is already amenable to rational human understanding, namely, the device lies in a normal geometric space. Such a realistic understanding is necessary for comprehending the underlying foundations of the existence of life and for engineering a full-fledged nanotechnology.

The existence of real physical analogues of clocks and lines that directly and literally participate in particle interactions are conditions for the objective existence of elementary particles and quantum measurement objectivity and for compliance of the Theory of Relativity by particles.

This requirement seems inconceivable, but Nature is more inventive than Man. A key mystery of the microcosm became evident after 40 years of electron microscopy research of the quantitative geometry of biological structures (Golubev, 1981, 1987, 1996a, 1996b, 2013a, 2013b, 2013c, 2013d; Golubev and Gerasimenko, 1989; Golubev and Golubev, 2009a, 2009b, 2010, 2011).

Analogue clocks resulted from the existence of elementary particles in the form of an alternation of two states with different properties that behave probabilistically and in accord with the uncertainty principle. Analogue lines appeared because of the quasi-crystalline structure of the physical vacuum that generates a real observed mass ratio and other features of the microcosm.

Given the volume and scale of unconventional consequences, no statement can remotely satisfy the requirement of the presence at each point of a microcosm of the “clocks” and “lines”, neither of which are drawn on paper but are physically real and participate in the particle interactions. The presence of such clocks and lines determines the actual structure of the microcosm with the following consequences:

- The correlations between the masses of elementary particles obtained are identical to those found in reality.
- Particles acquire probabilistic behaviour, begin to comply with the uncertainty principle and the Pauli Exclusion Principle and attain an opportunity to tunnel. Numerous other quantum effects emerge. There is also a realistic interpretation of the concept of “the proper time of the particle” that literally stops at the speed of light.
- The emergence of life and sense becomes regular deterministic processes.
- Biological evolution is a directed process. It is directed toward a slow, gradual adaptation to the physical vacuum as the real component of the environment. Because of this evolution, the geometric structure of living organisms transforms into a fractally increased chemical imitation of the key structures of the vacuum. Due to the direct geometric similarity to living organisms, natural analogue devices are ideally adapted to match the physical laws of the microcosm with those of normal physiology. That geometric similarity structure allows cells to live by the laws of the quantum world without requiring the solving of equations.
- Humanity has faced range of physical effects for many centuries, but from the standard scientific theories perspective, these effects are declared non-existent and pseudoscientific.

This article is a brief summary of the author's three interdisciplinary books and several articles on biology, physics and chemistry (Golubev, 1981, 1987, 1996a, 1996b, 2013a, 2013b, 2013c, 2013d; Golubev and Gerasimenko, 1989; Golubev and Golubev, 2009a, 2009b, 2010, 2011).

Life—A Special Form of Quantum Ordering of Matter in Time and Space

In biology, the term “coherence” is often used in various embodiments of the expanded value. In the unconscious form, it reflects the presence of a dynamic ordering in the matter of living organisms, the existence of which cannot be described in terms of the conceptual framework of standard theories. The existence of such ordering allows biological cells to live by the laws of the quantum world without requiring the solving of equations. This dynamic ordering of living matter represents a direct adaptation to the fact that quantum particles have an analogue clock, which is not invented by mathematicians nor drawn on paper, but instead directly and literally participates in particle interactions.

The presence of a “clock” at each point of the quantum world is ensured by the fact that the particles themselves can move and exist by alternating two structural states with different properties. Quantum particles are involved in the physical interaction in both states but in completely different manners. The direct consequence of the interaction is the probabilistic behaviours of quantum particles because the phase relation of interconversion between adjacent particles is generally random.

The properties of the particle are the sum of the properties of its two alternating forms. Any particle moves, however, so the sum can be determined only at such an interval of the particle movement when the both forms are present. Mathematically, the sum corresponds to the standard definition of the uncertainty principle. The line along which the particle moves in the form of the alternation of two forms with different properties can be called the trajectory only conditionally. Such a line is not a classical trajectory. For this reason, the concept of classical trajectory does not apply to quantum particles.

The pulsation period in terms of the Theory of Relativity corresponds to the concept of the proper time of the particle. At relativistic velocities, that quantum interconversion frequency decreases. At the speed of light, the alteration of states of photons and neutrinos disappears. The relativity theory calls this event the proper time stop of the particle.

Four types of fundamental interactions for microcosm time scales do not appear simultaneously; instead, they belong to two tandems. Each tandem is peculiar to one of the two alternating states of a quantum particle, hence providing the main sense of the idea of the Great combination of physical interactions.

At one stage, the particle is involved in two types of interaction with a formally unlimited radius of action: electromagnetic and gravitational. At the transition to another state, the particle transforms into the proper diffraction picture. With this inversion of the geometric structure of the particle, its interactions with its theoretically unlimited radius of action transform into the interactions with a very small radius of action. Electromagnetic interaction proceeds to the weak nuclear interaction corresponding to the analytic theory of single electroweak interaction. Gravitational interactions with inversion of the structure of particles are converted into strong nuclear interactions.

According to standard theory, the electrostatic interaction between the charges is provided by the exchange of virtual photons, namely, as alternating electromagnetic field quanta. This aspect of the theory is fully consistent with our assertion of the existence of quantum particles in the form of the alternation of states with different properties. Specifically, at the scale of the microcosm, the electric charges of the electron and proton are pulsating.

At the turn of the XIX and XX centuries, when scientists were attempting to penetrate into the microcosm, science faced compelling difficulties. Only now do we understand that due to the alternation of states with different properties, the force interactions between the particles attain a paradoxical specificity. Then, with respect to the microworld, the refusal to describe the force interactions resulted in the adoption of an energy approach. At that time, this adoption was forced but a necessary step. However, science, in this case, remained an unconquered fortress in which nature held the most intriguing and important secrets.

From the perspective of the energy approach to brain functioning, new evidence of the applicability of the law of energy conservation can be obtained. The impossibility of the perpetual motion is undisputed; rather, the principles of the brain are now understood as more concrete. Such an understanding requires knowledge of the specific laws of the force interactions of the particles in the microcosm. Compliance with Coulomb's law in the microcosm does not solve the problem, but in fact, makes it more difficult and treacherous. This point requires elaboration.

Electric action currents circulate inside the brain. How do they appear? To create a closed circuit that engages any type of work, a source of electromotive force (EMF) is required. Any EMF source functions because the electric charges move against the forces of the electromagnetic field due to what are known as external forces. This “countermotion” is responsible for creating EMF and maintains functioning in that part of the closed circuit that thus consumes electrical energy. In conventional generators, flowing water, compressed gas, wind or another source of external forces make the rotor winding move. Along with these generator details, the forced “countermotion” is performed using conduction electrons located inside their volume.

How, additionally, are closed electric currents inside the cell organelles conducted? How, at these scales, in biologically realistic conditions, are the outside forces transported to the single electrons or ions to make the latter move against the forces of the electromagnetic field? Modern physics has been unable to answer to this question. This issue is of the type that quantum mechanics has had to neglect, thereby refusing to describe the force in favour of energy.

When using the chemical batteries in macroscopic electrodynamics the ‘chemical forces’ operating within them are called extraneous forces. Indeed, the “chemical forces” have electromagnetic nature. In a flashlight the outside forces of not electromagnetic nature are not involved. However, the creation of a single electric battery or charging of the reusable battery is impossible without the use of external forces of not electromagnetic nature. Similarly, inside the organelles of the living cells it is impossible to create microscopic analogue of the disposable electric battery or recharge the analogue of the reusable battery without the use of external forces. This energy can be obtained, for example, by the absorption of light quanta. However, to realise the most orderly “countermotion” of charges the action of external forces remains necessary.

With the electrochemical processes at the intracellular scale, the “countermotion” of single electrons or ions appears due to a distinct type of managed and regulated quantum tunnelling. Nevertheless, understanding these processes requires the consideration of tunnelling itself, not at the level of the postulated paradox, but as a coherent consequence of the structural features of the microcosm. Within the model, the possibility of tunnelling results directly from the fact that in one of the two alternating states of quantum particles, electromagnetic interactions do not occur.

The elements of ordering in the alternation of the structural states of quantum particles with different properties are present in superconductors and more clearly so in a range of semiconductor constructions. In the unconscious form, this presence is reflected in modern physics by introducing the concept of the effective mass of the electron that can be greater or less than its normal weight in semiconductors. Such effects should not be confused with the processes at sub-light speeds (Golubev, 2013e, 2013f).

In Living Organisms, the Phase Ordering in the Alternation of the Structural States of Quantum Particles with Different Properties Becomes More Critical. This Dynamic Orderliness Establishes the Integrity of the Living Cells of a Living Organism

Phase ordering in the alternation of states with electromagnetic interactions and states without such interactions creates a local inhomogeneity of the electric resistance with extraordinary properties, which are unaccompanied by changes in the chemical composition and biological morphology. Well-known acupuncture points exhibit such properties. Analogues are present even in animals and plants.

Nanotechnology has yet to use bionics and learn from living organisms to create systems with phase ordering alternating states of quantum particles. In biology, this order causes an asymmetry in the left and right structures through highly specific mechanisms (Golubev and Golubev, 2011; Golubev, 2013e, 2013f). This result is noteworthy mainly because this order allows the existence of biological sources of the electromotive force, within which electrons or ions due to the external forces must move against the forces

of the electromagnetic field. The misunderstanding of "countermotion" implementation principles of single electrons and ions does not allow technical systems to reach the level of miniaturisation that exists in living subjects. Therefore, an understanding of the specifics of the force interactions of quantum particles has become imperative for nanotechnology.

A phase sequence enables numerous extraordinary, rare effects. For example, there is non-vanishing probability of the ratio of the phases in which a person remains alive even after being hit by electric lightning. Such cases do happen, and afterward, unusual abilities sometimes appear. Generally, this appearance results from the extreme impact on the phase relation with the alternation of structural states of quantum particles. However, research offers a far from detailed understanding of these processes. The resonance effects at the alternation of states of quantum particles stand behind these extraordinary phenomena that were studied by Tesla for many years.

Both alternating states of elementary particles have a size and geometric shape. At the first approximation, they are interconnected by a spatial inversion. The spontaneous attempts at a formal merger of both form options generate the notion of a particle without geometric shapes and sizes. The alternation of states of quantum particles in compliance with the law of inertia requires compliance with the Pauli principle. The key to the geometric structure of elementary particles is a way to implement the analogue line in the quantum world.

Quasicrystals in Biology and in the Vacuum Structure

Line as the standard length requires at least two points. Therefore, a line cannot be inside each point of the microcosm. However, it is sufficient if each point forms part of the three-dimensional structure of natural lines. It is impossible to obtain such lines by returning to the classical hypothesis crystalline ether because all points of the classical ideal crystal cannot, in principle, be distinguished from each other. Therefore, the "division" of such lines cannot, in principle, be digitised in any manner, either.

The periodicity of the structure and the principal indistinguishability of its component points are, by definition, identical. The necessary non-periodic structure was discovered by the famous British mathematician Roger Penrose approximately 50 years ago (Penrose, 2003). Nevertheless, for decades, three-dimensional Penrose patterns or pentagonal quasicrystals were perceived merely as entertaining mathematical puzzles.

In 1984, quasicrystals were obtained not in the form of pictures, but in patterns of metal alloys (Schechtmann et al., 1984). The Nobel Prize in Chemistry for obtaining metallic quasicrystals was awarded in 2011, approximately 30 years after the metal samples themselves and their diffraction patterns were discovered. Immediately following the discovery, the metal quasicrystals were considered "pseudoscience". Convincing evidence of the quasicrystalline of such ephemeral substance as the physical vacuum and such complex objects as living organisms require significant amounts of time to gather. The initial ideas of the quasicrystalline of the vacuum and biostructures were published in 1996 (Golubev, 1996a, 1996b). Several articles and the books are devoted to that topic (Golubev and Golubev, 2009a, 2009b, 2010, 2011; Golubev, 2013a, 2013b, 2013c, 2013d).

The non-periodic filling of the volume, i.e., for quasicrystal construction, requires only two varieties of elementary cells, namely, two types of rhombohedrons of a special form for which the ratio of volumetric diagonals equals the famous proportions of the golden section (Fig. 1). This requirement is neither mystical nor accidental but is the result of the appearance of quintic symmetry axes. The presence of the axes is incompatible with the periodicity of the structure and is prohibited for classical crystals. For aperiodic quasicrystal structures, however, such symmetry is inevitable.

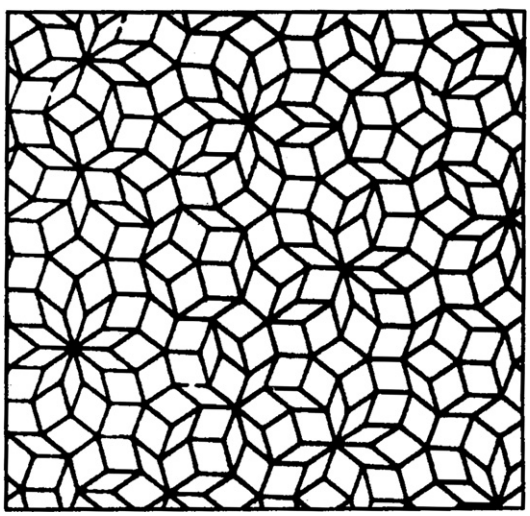

Fig. 1. Penrose pattern, filling of the volume of non-periodic alternation of two grades of elementary cells. These are two rhombohedrons of a special form in which the ratio of the volume of the diagonals equals that of the golden section. In the case of the physical vacuum, when such an ordered structure around elementary particles and atomic nuclei arise, there are no diffuse virtual "clouds", as considered in the standard theory, and a hard-quantised virtual shell that are geometrically similar to fullerenes.

Despite the tremendous variety of organic substances, their carbon frame is displayed with high precision by a certain set of fragments, namely, only two crystal lattices of pure carbon: diamond and graphite. In any biological structure, such fragments of diamond and graphite lattices replace two types of rhombohedrons of a canonical quasicrystal, i.e., as a more complex quasicrystalline structure.

A physical vacuum with an aperiodic quasicrystal structure can be compared with the gas of crystal dislocations and considered a type of synthesis of two classical hypotheses of crystalline and gaseous ether. Such a vacuum, however, does not contradict the Theory of Relativity; moreover it is required for its applicability to the microcosm, thereby ensuring the availability of an analogue line at each point. Features of the quasicrystal symmetry that do not allow using such a vacuum as an absolute reference system are discussed in detail in books (Golubev, 2013e, 2013f).

The Fundamental Uniqueness of the Carbon and Structural Mechanism of the Mass of Ordinary Matter

For half a century, the understanding of quasicrystals has transitioned from being a mathematical puzzle to corresponding to key structures of our world. In the quasicrystalline structure of the vacuum, the virtual shells of the real particles and atomic nuclei are not diffuse “clouds”, as is assumed today. Virtual environments are clearly structured and rigidly quantised components of particles, and the nuclei of the geometric structure of these shells are similar to fullerenes. Such shells are formed for greater than 99% of the known substance and determine the actual observed correlations between the masses of the particles.

Among the fullerenes that are extraordinary carbon compounds, the molecule C_{60} is distinctive. Elementary particles with a shell geometrically similar to C_{60} are the proton and the neutron. The algorithm for calculating the mass of these particles is more straightforward than expected. Acquiring the shell of 60 virtual particles, the particle becomes a complex of 61 particles (Fig. 2).

Virtual particles do not have a proper weight, but the very existence of an ordered structure is possible only when specific interactions with each other and with the central core samples (i.e., with a real particle) occurs. In the system of 61 particles, only 1830 pairwise interactions are possible in a combinatorial sense. The contribution of each of them to the total mass of the proton equals the electron mass m_e that is a natural standard unit of mass. The total contribution of the shell is 1830 m_e. The structure of the proton core sample corresponds to the quark theory (Fig. 3).

Three quarks and three gluons provide all possible combinations of interactions between quarks. Each quark mass and the dynamic equivalent of each gluon mass equal the electron mass m_e. The overall proton core mass is 6 m_e. The increase in the total mass of the proton to 1836 m_e is provided by a discrete virtual shell of 60 virtual particles. Geometrically, such a shell is analogous to fullerene C_{60}. The contribution of this shell to the proton mass is determined by the fact that in the system of 61 particles (60 + real core of three quarks), there are 1830 combinatorial pair interactions, each of which increases the weight of m_e.

The core mass is 6 m_e and forms as the sum of the masses of three quarks with a mass m_e of each and that of the three gluons, each weighing m_e as well. Three gluons provide all three combinatorially possible pairwise interactions between the three quarks. Gluons have no resting mass; their mass is a relativistic mass equivalent. The full estimated mass of a proton is 1836 m_e, with the actual weight being 1836.15 … (m_e), with 0.008% of the calculating error. The virtual shell of the proton and neutron are identical, but for dynamic reasons, the mass of the neutron core is 8.7 m_e.

Over time, the combination of protons and neutrons in the atomic nuclei of the individual shell of 60 virtual particles is lost. Instead, there remains a single shell for the entire atomic nucleus as a single entity. For example, the shell of an alpha particle (helium nucleus) is similar to fullerene C_{120}. Together with the core samples, they represent a set of 121 particles in which 7260 pairwise interactions are combinatorially possible. They form a mass of 7260 m_e. The core mass of the alpha particle is the sum of the masses of two protons cores and two neutron cores (6 + 6 + 8.7 + 8.7) m_e = 29.4 m_e. The full weight of the alpha particle is: (7260 + 29.4) m_e = 7289.4 m_e = 4.00 amu.

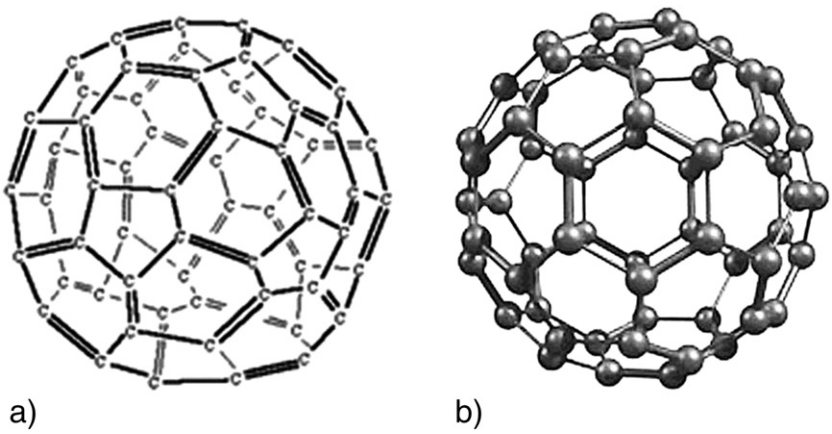

Fig. 2. Structure of the fullerene molecule C_{60}: a) structural chemical formula; b) the model representation. The virtual shell of the proton exhibits this geometric structure.

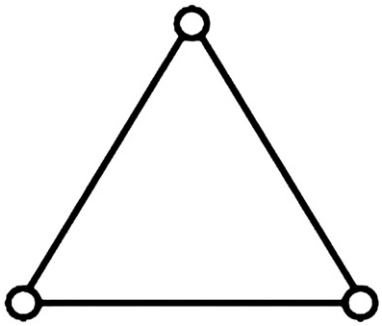

Fig. 3. Structure of the proton core.

A similar mass calculation of chemical elements and their isotopes within the entire periodic table reveals the undeniable correlations between the structure of the atomic nuclei of the virtual shells and the real properties of the atoms themselves. The mass of the basic types of elementary particles is calculated with the same algorithm. In particular, the mass of the muon is calculated with an error of less than 0.01%. The structural mechanism by which the virtual shell, geometrically similar to fullerene C_{60}, determines the numerical value of the famous dimensionless constant 1/137 at an accuracy of 10.4% was decrypted.

The natural mechanism of mass formation is universal for all atoms of the periodic table of elements, as well as for the various elementary particles (Fig. 4, 5).

The details of this mechanism are such that only with the formation of the atomic mass of carbon do the particular resonance phenomena appear at the level of the vacuum effects. Greater than 99% of all known substances create the virtual shell of nuclei, whose geometric structure are similar to that of fullerenes. Carbon, forming the chemical fullerenes, is the only element that creates chemical analogues of the most fundamental structures of the physical vacuum. Of course, the molecular analogues are created with a fractal increase in the absolute size. The possibilities of living organisms in terms of the creation of such chemical imitations or analogue models of physical vacuum show greater potential.

Electromagnetic resonances arise when the photon energy matches the energy difference between two levels of an electron and sometimes other particles. Resonances in the physical vacuum arise at the interaction with mass (energy) equal to the mass difference between two particles carriers of one of the four types of fundamental interactions: weak nuclear forces. Such particles, as is widely agreed, are charged and neutral vector bosons. The difference in the masses of these particles with an accuracy of approximately 2% coincides with the atomic mass of carbon C^{12}.

These direct geometric similarities of the structure of matter and the structure of the physical vacuum are key to many biological problems. This similarity of structures is the real cause of the extraordinary properties of chemical fullerenes.

The uniqueness of carbon is directly related to the existence of life. For a proper understanding, it should be added that the occasionally re-emerging hypothesis concerning the possibility of life based on silicon is a misunderstanding, regardless of recent results. Silicon does not form compounds with aromatic type of connections, and without the latter, it is impossible to obtain an analogue of biochemistry.

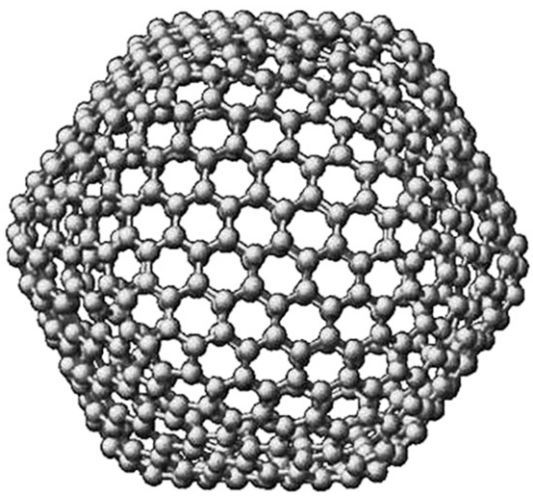

Fig. 4. Model representation of the real life of the fullerene molecule C_{540}. This structure has a virtual shell of nuclei comprising selenium and bromine.

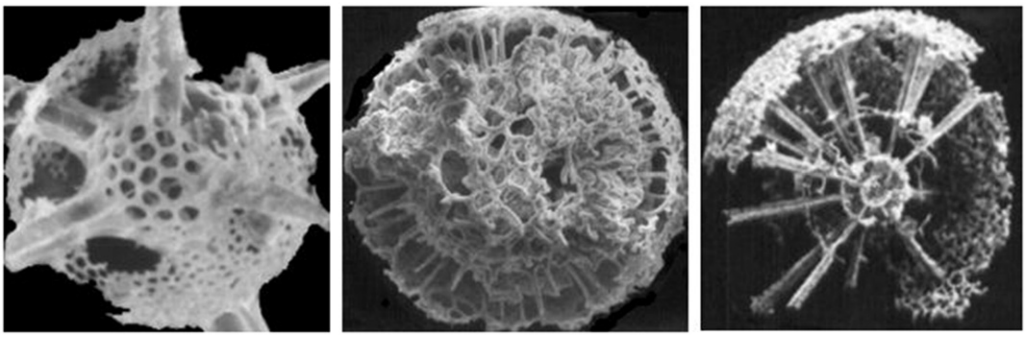

Fig. 5. Any illustration of the fractal system of virtual shells of elementary particles is necessarily conditional. Rather than arbitrary figures, we present electron-microscopic photographs of unicellular radiolarian shells provided by M.S. Afanasieva. This system consists of several concentric shells of porous silica, with a size of approximately 50 microns. All radiolarians have a planktonic lifestyle. With the real values of the specific density of the cytoplasm plankton, diving with the ballast in the form of the shells shown in the pictures is impossible without the use of non-trivial gravitational effects. An extraordinary analogue is that inside a fractal system of virtual shells of neutral and charged vector bosons, according to the model of virtual shells, there is the core with a negative mass.

The virtual shell of nuclei generates long-standing familiar effects that were not understood. For instance, the atomic nucleus of the main carbon isotope C^{12} has a shell of 208 virtual particles. A complex of 208 protons and neutrons constitutes the nucleus of lead Pb^{208}. There is also a specific fractal, the existence of which cannot be displayed as part of the conceptual apparatus of the standard theory. Among the many toxic heavy metals, lead in this regard does not stand apart. However, this element has a unique ability to penetrate into the body through intact skin. Fractality by definition signifies the presence of a geometrical similarity amongst structures, in this case, subatomic structures. A general rule, i.e., "similar dissolves similar", has been known to the field of chemistry since the times of alchemists.

The Origin of Life—Realistic Simplicity

There is a definitive way to construct a deterministic model of the origin of life. The process of matrix formation of mineral crystals inside living organisms composed of such objects as bones, teeth, shells, and mineral precipitates of procaryotes should be consistently imagined as moving backward. This approach, in principle, should make possibly only a model of life on crystal matrices of the same specific minerals: apatite, calcite, aragonite and tetragonal cristobalite (the clusters of the latest form of the skeletons of macroscopically amorphous silicon dioxide).

It is necessary to satisfy one condition. It is insufficient to consider the process of the formation of mineral crystals in the formation of objects such as bones and shells as a process of chemical synthesis of the respective inorganic compounds. The biomineralisation process should be represented in terms of morphogenesis. Attention should be given primarily to the geometric structure, particularly to the pairing mechanisms of mineral crystals with liquid crystals of biopolymers. The structural principles of coupling are universal for organisms from prokaryotic organisms to human beings and for the biological processes of formation of chemically very different minerals, namely, apatite, calcite, aragonite, and cristobalite.

Our model of the origin of life is a detailed elaboration of the D. Bernal hypothesis (Bernal, 1967). Integrating the ideas of Bernal with the "clay hypothesis" was implemented by popularisers. Bernal himself wrote directly on the likely involvement of apatite crystals in origin of life due to the occurrence of this mineral in the bones and teeth of modern organisms. Bernal, however, did not have a detailed electron-microscopic picture of biomineralisation. The model of life, constructed from this perspective, explains the real-life and purposeful language of the genetic code, the cell structure of the flagellum, the mitotic spindle, and other features of life (Golubev, 1987; Golubev, 2013e, 2013f).

The origin of life is transformed into a natural process due to the extraordinary, but absolutely real system of coordinated or identical structural parameters. The 'chance' underlying the origin of life is not a rare event, but a set of extraordinary coincidences of structural parameters in a completely different crystals and molecules is rare. In particular, the proportion of the dimensionless crystallographic elementary cells involved in the mineral biomineralisation with high accuracy becomes a power series of the golden section (the power exponent is not only integral but also assumes the values 1/3, 2/3, 1, and 4/3). This mineralogical "oddity" converts the emergence of life in the natural process. The real reasons for the entire system of such unexpected coincidences, however, are associated with the quasicrystalline vacuum, the entire structure of which is built on the power series of the golden section.

The creation of model of the origin of life requires crystallographic knowledge. Without it, the question of the origin of life cannot be pursued. The "Ancestors" of ordered living structures in principle could only be ordered, "yet" not living structures. These structures by definition occur in such forms as crystals, liquid crystals, and quasicrystals. Without specific knowledge about these "ancestors", a debate on the origin of life will remain irrelevant. The problem of the origin of life is inevitably replaced by debates on abstract self-organisation, and isolation from biology compensates by using complex mathematical formulas.

Mind in the World of Vacuum Quasicrystalline

In an ordinary computer, cybernetic functions are performed by classical crystals with impurities or other deviations from the ideal lattice. A quasicrystal, with its non-periodic structure, can be formally considered as an extreme case of classical crystal that maintains only a deviation from the ideal lattice. As a first approximation, it is a dislocation gas, i.e., an extraordinary mixture of two classic hypotheses, namely of the crystalline and the gaseous ether. The entire quasicrystal consists only of these points, each of which is able to perform the cybernetic functions; therefore, this crystal offers an optimal design for the structure of the brain. At the software level, such a cybernetic system must use the specific value systems, known as the golden ratio codes or Fibonacci codes. Consequently, the natural feature of the cybernetic brain with a quasicrystalline structure of the material is an optimal tool not for ordinary arithmetic operations but for the task of pattern recognition (Golubev, 2013e, 2013f).

When using the Fibonacci number system, the work of a physiological algorithm for recognising visual images directly generates the golden section in architecture and painting. Similar recognition algorithms of auditory images facilitate the implementation of the golden section in music.

The exceptional structure of quasicrystals allows following the logical chain from the realisation of clocks and lines in the world of elementary particles to the emergence of life and mind. Moreover, this logical circuit directly involves the implementation of the golden section in products of the intellect, such as architecture, painting and music.

Common Sense and Life in the World of Quantum Mechanics

Quantum mechanics is considered paradoxical because the behaviour of elementary particles seems counterintuitive. This contradiction, however, is now being surmounted. Specific physical phenomena are changing beyond recognition with changes in the scale at which they are viewed. Conventional mechanical friction at the atomic level converts into an electrical interaction between particles on friction surfaces. Behind today's clarity of this fact is the labour of many generations. Moreover, in the eighteenth century, due to the lack of knowledge, the mechanistic approach was attempted to be applied outside of its remit of applicability. Contemporary attempts of mechanical explanations in electricity and magnetism may seem naive, but we should not scoff at our predecessors; rather, we should critically examine ourselves. It should be considered that one of the central concepts of modern physics, the concept of a material point, has limits to its applicability, too. The main reason for many crises in modern physics is that transcending the limits of applicability of the concept always remains unnoticed for a long time.

The paradoxical nature of quantum mechanics is created by the constrained representation of particles with a complex structure by material points. Neither is the concept of a material point applicable for elementary particles, nor is the concept of the light beam. Quantum mechanics remains a deeply modernised version of material point mechanics, the reason why it is as formal as geometric optics. For example, formulas of geometrical optics correctly describe the operation of the lens and other mechanisms. In the unconscious form, the paradox of the lack of material points has been provoking the emergence of the attempts of semi-mystical or frankly mystical interpretation of microphysics for more than 100 years.

From the physics of the material point, the process must move toward the real and genuinely complex geometric structures and eventually to the dynamically pulsating structures. Material points, unlike quantum particles, do not pulsate spontaneously. Along with the development of quantum mechanics, the list of classical physics concepts that were inapplicable for quantum mechanics has also been expanding. This list referred, however, to the properties and attributes of the material point. Only the inertia of the conceptual apparatus and the human mind impeded the comprehension that the concept of a material point in the world of particles could also be rethought as the concept of a light beam.

For approximately 100 years, the inability to use ether, a physical vacuum or particles of the microcosm as an absolute reference system has been considered a paradox of relativity theory. In fact, this paradox is the inertia of the traditional conceptual apparatus. It must be clearly understood that if the points of the microcosm cannot be used as an absolute reference frame, then they simply do not correspond to the notion of a material point. This property is not a paradox, but a feature of the symmetry of complex structures. Physical vacuum connects the points of the microcosm in a single structural network type of a quasicrystal or Penrose pattern. Any impact on one point is replicated by another 59 points. That feature exemplifies the symmetry of the vacuum. It is impossible to facilitate useful research with a single selected point. In particular, there is no physical meaning in the attempt to declare a point as a beginning of an absolute reference frame because it cannot be distinguished from the neighbouring points. A material point does not possess these properties. Unlike tangible points, quantum particles do not exist by themselves, but are always part of the microcosm. There is nothing irrational in the existence of such links, but this existence is a barrier to admissible simplifications in the study of the microcosm. Even in classical mechanics, it is impossible to move only one point of the billiard ball. Only the entire ball can be moved, or a certain part of its volume can be deformed. In the microcosm, similarly, a single point cannot be manipulated.

Today, some authors try to refute the Theory of Relativity. The validity of this theory refers to the inapplicability of established notions of a material point to the microworld. As part of the formal mathematical approach, the possibility of the existence of the material microcosm without material points does not occur. Therefore, the Theory of Relativity is either perceived as an inexplicable paradox (the most common perception today), or is altogether denied (a perception of few researchers).

The lack of a stable absolute reference system in the world of particles is perceived as a strange paradox as long as a one considers the points being laid on a sheet of paper. These particles yield not a paradox, but the apparent triumph of common sense. To use an electron (or other particle) as the origin of the absolute system of coordinates requires marking that electron, distinguished for a long time from the other electrons and repeatedly used as a reference point in a series of successive measurements. To elementary particles, in general, it is impossible to apply techniques known as non-destructive methods, observations or measurements. After

the first measurement, the state of the conditionally selected electron changes because of the interaction with the device. Accordingly, a quantum particle cannot, in principle, be used as the basis for a stable system of coordinates, the reason why the basic principle of relativity is valid in the world of quantum particles.

The standard theory accepts the chaotic physical vacuum only by default. Therefore, the comprehension that the vacuum actually has an ordered structure does not pose conflicts with existing views. Distinct features of quasicrystalline vacuum symmetry create new opportunities for the previously unapprehended explanation of the facts. In physics, this explanation is primarily a structural explanation of the relationship between particle masses, including the masses of atomic nuclei. Additionally, in biology, the understanding of the role of the vacuum in the structure of ordinary matter fundamentally changes the general perspective.

At the foundation of physics, the model of quasicrystalline vacuum makes only a single change. According to the standard model, there are diffuse “clouds” of virtual particles around the elementary particles. The features of the geometric structure and the symmetry of the quasicrystalline cause the replacement of vacuum diffuse “clouds” by the firmly quantised and clearly structured virtual shells. This is the only change, but the replacement of diffuse "clouds" by discrete shells generates an avalanche of logical consequences and generates a new general physical picture, thereby changing the perspective for not only elementary particles but also for the shells and the entire understanding of biology.

The scope of this article does not allow for an elaboration of the explanation of the biological asymmetry of left and right structures, the occurrence of irreversible processes for participation of Higgs bosons in the mass formation of each proton and the mass of ordinary matter, in relation to the nature of dark matter and many other diverse phenomena. The list of problems that are already being solved to a certain extent by the quasicrystalline vacuum model is extensive. If a model of vacuum is valid, however, then no other outcome is to be expected.

Moreover, the quasicrystalline structure of the vacuum provides a realistic explanation of certain of these phenomena, the existence of which is incompatible with generally accepted notions. In the material microcosm, without material points, there exist relatively extraordinary and paradoxical phenomena. These questions are addressed in books (Golubev, 2013e; Golubev, 2013f) by considering current capabilities.

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